

**Arnold  
Engineering  
Development  
Center**

*...timely development and continued operational  
effectiveness of advanced technology aerospace systems*



**Test Planning Information and Requirements  
for Wind Tunnel Tests in the  
Aerospace Flight Dynamics Wind Tunnels**

Calspan Corporation/AEDC Operations  
Operating Contractor  
Aerospace Flight Dynamics Facilities

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**AIR FORCE SYSTEMS COMMAND  
UNITED STATES AIR FORCE**

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**TEST PLANNING INFORMATION  
AND REQUIREMENTS  
FOR WIND TUNNEL TESTS IN THE  
AEDC AEROSPACE FLIGHT  
DYNAMICS WIND TUNNELS**

**AUGUST 1988**

**AEROSPACE FLIGHT DYNAMICS FACILITIES  
ARNOLD ENGINEERING DEVELOPMENT CENTER  
AIR FORCE SYSTEMS COMMAND  
ARNOLD AIR FORCE BASE, TENNESSEE 37389**

## **FOREWORD**

To accomplish wind tunnel test programs in the Aerospace Flight Dynamics Wind Tunnels in an efficient and timely manner and to maximize test information return, it is imperative that adequate pretest planning be performed. Poor planning can result in unsatisfactory test results and cause delays in test schedules.

The general policies and procedures for wind tunnel tests, currently in force at the Arnold Engineering Development Center (AEDC), are outlined in Volume 1 of the AEDC *Test Facilities Handbook*. Detailed information concerning test capabilities, instrumentation, and information applicable to the AEDC Aerospace Flight Dynamics Wind Tunnels are also included in the *Test Facilities Handbook* available from the Air Force Directorate of Aerospace Flight Dynamics Test.

If additional information is required, please contact the Directorate of Aerospace Flight Dynamics Test, Arnold Air Force Base, Tennessee 37389 (Phone 615-454-5280 or Autovon 340-5280).

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## **SECTION 1.0**

### **INTRODUCTION**

To accomplish wind tunnel test programs in the Aerospace Flight Dynamics Wind Tunnels in an efficient and timely manner and to maximize test information return, it is imperative that adequate pretest planning be performed. This document has been prepared to inform the test User and Sponsor of information required to conduct a test program and the procedures followed during test conduct. A chart is presented in Appendix A which shows the progression of activities involved in conducting a test program. The chart, along with the other information presented herein, can be used to determine the timing for various aspects of the program, and to assist in the coordination of activities between User and Calspan personnel.

## **SECTION 2.0**

### **RESPONSIBILITIES**

#### **2.1 AEDC/DOFA STAFF**

The principal mission of the AEDC is to provide environmental test support for systems and research and development programs of the Air Force and other Department of Defense and Governmental, as well as non-Governmental agencies. The AEDC Air Force staff is responsible for overall test planning, direction, scheduling, establishing priorities, and funding associated with accomplishment of the AEDC mission. Accomplishment of tests conducted in the AEDC Aerospace Flight Dynamics Test Units is the joint responsibility of the Air Force, the test Sponsor/User, and Calspan. The AEDC Air Force Project Manager is the Pont-of-Contact for all AEDC support.

#### **2.2 CALSPAN CORPORATION/AEDC OPERATIONS**

The Aerospace Flight Dynamics Wind Tunnels in the PWT and VKF test facilities are operated and maintained by Calspan. Calspan is responsible to the Air Force, AEDC, for the efficient and professional conduct of all Aerospace Flight Dynamics Test activities, and for the attainment of test objectives resulting from testing activities. Calspan assigns a Project Engineer to coordinate all testing activities associated with a particular test program. The Project Engineer provides technical support and liaison between the User, Sponsor, and Air Force Project Manager.

## **2.3 SPONSOR**

The Sponsor is the agency that has the requirement for support from AEDC. The Sponsor bears the overall responsibility for test planning, programming, and funding of tests conducted at the AEDC. The Sponsor's test representative is responsible for ensuring that test planning requirements are met for conducting a test program at AEDC.

## **2.4 USER**

The User, normally under contract to the Sponsor or the developer of the hardware under test, serves as the technical Point-of-Contact for the Calspan Project Engineer and is responsible for providing all information to AEDC necessary to meet the established test objectives.

# **SECTION 3.0**

## **TEST PLANNING REQUIREMENTS**

The sequence of events for a test program, from the initial test inquiry through report documentation, is shown in Appendix A. Once the test feasibility has been determined by AEDC, the Air Force informs the Sponsor organization and releases a Preliminary Engineering Authorization (PEA) to Calspan to perform preliminary engineering and prepare an AEDC Project Plan.

## **3.1 TEST PLANNING CONFERENCE**

A conference among the Sponsor, User, Calspan, and AEDC Air Force personnel is held prior to the start of the test program to establish test objectives, scope, and schedule. The conference agenda should be sufficient in scope to define and delineate responsibilities for further actions. A preliminary estimate of test unit occupancy time may be made at the conference, but a detailed study of the test requirements will be made by AEDC before an official estimate of the test costs is supplied to the Sponsor. The basic decisions influencing the division of responsibility between the User and Calspan and identification of Unique Test Requirements items are made during the Test Planning Conference. Unique Test Requirements are services or items for a test project which exceed the level of support normally provided a User. Unique Test Requirements include services or items such as modifications of the test unit, design and fabrication of equipment to adapt the test article to the test unit; materials, services, or equipment not Government furnished, including special fuels, oil, gases, and chemicals; analytical and advisory services; special data reduction requirements; and special instrumentation.

Calspan provides the User with a test planning package which includes information on the following items: Test Planning Information, Test Article Design and Strength Requirements, Data Reduction, Graphics Capabilities, and Quality Control Program. Other information packages, relevant to the test program, will be provided to the User by Calspan as required.

### **3.2 PRETEST CONFERENCES**

Pretest conferences are scheduled through the Air Force Project Manager and are chaired by the Calspan Project Engineer. One or more pretest conferences will be required, depending on test program complexity, to define completely the test scope (Mach number, angle of attack, angle of sideslip, Reynolds number, corrected weight flow, nozzle pressure ratio, etc.), data reduction requirements, and all hardware and instrumentation interface between the User and Calspan. The User Pretest Report (Section 3.3) and User Test Plan (Section 3.4) are the formal documents required to communicate test requirements to AEDC. Also to be provided by the User is a Model Stress Analysis report. It is the responsibility of the User to perform a stress analysis sufficiently comprehensive in scope to preclude further exploration by Calspan except for checking. Detailed requirements for a stress analysis are outlined in the pertinent Calspan Test Article Design and Strength Requirement Manual.

The foregoing emphasis on test planning has been made to reduce the number of revisions to the design and fabrication of test models and to emphasize the importance of communicating detailed test requirements to AEDC so that an AEDC Project Plan (Section 3.5), which includes an estimate of the labor and material resources required for the test program, can be prepared. It is of major importance that the stress analysis, model loads, and model drawings be submitted to Calspan before or at an early stage of model fabrication so that any changes required by Calspan may be incorporated in the design. Otherwise, the User runs the risk of having to change finished components or of having restrictions imposed on his test program.

It is also the responsibility of the User to have the model assembled before shipment to AEDC in order to have all discrepancies corrected at the home plant. This should ensure that all model parts properly fit together, that all remotely controlled model components function properly, that all position indicators can be calibrated, that sufficient clearances are provided for differential deflections due to airloads and thermal expansions, that all leads are identified, and that all pressure leads are cleaned, open, and leak-checked. All pressure components must be proof-checked per instructions in the Test Article Design Information Handbook.

### **3.3 USER PRETEST REPORT**

A pretest report is to be prepared by the User which should encompass all test requirements, including delineation of the division of work responsibility, for the subject test program. The User Pretest Report should be provided to AEDC a minimum of 14 weeks before the scheduled test date or as mutually agreed to by the User and AEDC and should follow the guidelines shown in Appendix B. Other information required by Calspan at this time includes: 1) three complete sets of detail model drawings, 2) three sets of schematic diagrams for electrical, hydraulic, and pneumatic systems, 3) two copies of the expected model component loads and two copies of the model stress analysis, 4) two complete sets of balance drawings and a stress report for the balance if a balance is supplied by the User, and 5) complete calibration of all User-furnished instrumentation and the calibration equipment necessary for final calibrations at AEDC if not provided by Calspan. AEDC will normally insist upon assuming responsibility for pretest calibration of model balances, potentiometers, strain gages, transducers, etc., to ensure compatibility between the calibration and test unit instrumentation systems.

### **3.4 USER TEST PLAN**

The User Test Plan is a detailed test matrix (Mach number, angle-of-attack range and increments, angle-of-sideslip range and increments, Reynolds numbers, corrected weight flow schedule, nozzle pressure ratio schedule, model configuration changes, etc.) for the test program in the test facility. The test matrix is usually included in the User Pretest Report; however, revisions are normally made to the test matrix by the User in the time between the due date of the User Pretest Report and the test date. If these revisions are significant, they could impact the test program cost to the Sponsor, necessitating the commitment of additional resources to meet the revised test requirements. It is imperative that the User representative coordinate any changes to the test matrix with the Sponsor, the Air Force Project Manager and the Calspan Project Engineer so the test program resource requirements can be re-evaluated.

### **3.5 AEDC PROJECT PLAN**

The information included in the User Pretest Report, the User Test Plan, and verbal/written communications from the User to the Calspan Project Engineer is summarized by the Project Engineer in an AEDC Project Plan, together with labor and material resources (estimated by the Project Engineer and support organizations at AEDC) required to meet the test requirements. Upon approval of the AEDC Project Plan by the Sponsors, the Air Force prepares and releases to Calspan a Requirements Document which authorizes expenditures of resources necessary to accomplish the test requirements and objectives established for the



test program. The AEDC Project Plan should be approved by the Sponsor approximately seven weeks before the test date so that the test project resources will be available when required. As a result, it is imperative that the User-supplied test requirements be made available to AEDC at the earliest possible date to allow sufficient time to prepare and obtain approval to commit the test plan resources. The major elements of the AEDC Project Plan are:

1. Security/Protection
2. Type of Test/Project
3. Test/Project Objective(s) and Scope
4. Reference Correspondence or Documents
5. Test/Project Contacts
6. Project Schedule
7. Project Cost
8. Test Article Description
9. Test Matrix
10. Instrumentation Summary
11. Data and Reporting Specifications
12. Test Deficiency Reporting
13. Responsibility for Interface and Support Requirements
14. Miscellaneous Comments

### **3.6 MODEL DELIVERY, INSPECTION, AND CHECKOUT**

Models should be delivered to AEDC at least *three* weeks before the scheduled starting date of the test program. When special instrumentation is necessary or when calibration and/or installation procedures are extensive, additional lead time may be required and should be identified during the test planning conference. Special instrumentation and equipment for installation and calibration of the model may be furnished by the User and delivered with the model.

Model shipping instructions are given in Volume 1 of the *Test Facilities Handbook*. The items addressed in Volume 1 include: 1) Bills of Lading, 2) Communciations, 3) Consignment, 4) Accountability, 5) Security, 6) Freight Service, 7) Airport Facilities, 8) Receiving and

Handling, 9) Handling Equipment at AEDC, 10) Storage Facilities, 11) Personnel, 12) Outbound Shipments, 13) Carrier Claims, and 14) Completed Project.

Model inspection and checkout requirements should be identified during the Test Planning Conference (Section 3.1) and explicitly defined in the User Pretest Report (Section 3.3). All model hardware will be inspected when received at the Facility for any obvious damage due to shipping or mishandling.

### **3.7 SPONSOR/USER WORK AREA REQUIREMENTS**

Office space, data analysis areas, and model buildup areas are available for the Sponsor and User personnel within the AEDC wind tunnel complexes. As a normal practice, office space is provided in or near the facility office buildings. In general, data analysis areas are available in the Wind Tunnel Control Rooms, which have interactive graphics terminals for accessing the test data file resident in the facility or the AEDC central computer complex. Additional interactive graphics terminals can be made available in the terminal rooms within the facility office buildings. Model buildup areas are provided in model installation buildings near the test areas while the test program is in progress.

## **SECTION 4.0**

### **TEST SUPPORT REQUIREMENTS AND TESTING GUIDELINES**

#### **4.1 TEST OPERATIONS**

Preparation of a model for testing after it has arrived at AEDC may be done either by Calspan or by the User, who may provide craft and technician-type personnel to work on User-supplied elements. Installation of the test hardware in the wind tunnel or test cart will be done by Calspan craft personnel. User engineering personnel should be present during model buildup and testing to provide User-oriented technical direction in the event of unexpected developments and/or as required to modify the test program as indicated by test results.

The regulation of activities during testing operation is done from the Wind Tunnel Control Room. The Calspan Project Engineer requests the Test Engineer/Coordinator to set specific test unit test conditions. After the required test conditions are reached, the desired data are recorded. The Calspan Project Engineer and the User Representative are in very close communication during this stage and may introduce changes in the test variables as indicated by analysis of the test data. If the proposed changes are beyond the scope of the AEDC

project plan, they must be approved by the test Sponsor and the Air Force Program Manager. The User and Sponsor Representatives must communicate with the test personnel through the Calspan Project Engineer, as must any User's agent, such as representatives of the engine or control system subcontractors.

The User has the option of providing operators for his model controls where safety of the AEDC equipment is not involved. Calspan personnel usually operate test model controls and do so in accordance with any instructions that the User supplies. In the case of complex or experimental model controls, the User may wish to train some of his personnel as a test objective. Even in such cases, the User is requested to permit the training of Calspan operators to provide relief during the testing period so that delays in testing may be avoided.

During the testing period, it is important that emphasis be placed on high quality data productivity. It is necessary that tests be completed in an absolute minimum of occupancy time. Configuration changes should be designed, if possible, to be accomplished remotely. If this is not possible, the design should emphasize quick changes and preassembly with "dry runs" conducted by the User before the model is shipped to AEDC. Special attention should be given to changes that must be made to hot models, i.e., those tested in high temperature environment.

#### **4.2 EXPLOSIVES AND ITEMS CONTAINING EXPLOSIVES**

Explosives and items containing explosives cannot be used at AEDC unless Department of Defense (DOD) hazard classification and storage compatibility group designations have been officially assigned. Typical designations are 1.3C, 1.1D, 1.2B. Do not send explosives or items containing explosives to AEDC until DOD designations have been determined and forwarded to AEDC.

#### **4.3 TOXIC OR HAZARDOUS MATERIAS**

Identification and evaluation of toxic or hazardous materials associated with test projects and their potential effects on employee and environmental health are essential for effective test planning and timely testing. Specific information for each toxic or hazardous material must be supplied as early as possible so that special protective measures, if required, can be established without delay of the test.

Information needed for adequate evaluation includes:

- chemical formulas/constituents (at least generic constituents)
- total quantity and percentage for each constituent
- expected quantity of material to be emitted or ablated
- quantity percentage of emissions, by-products, or decomposition products
- radioactive characteristics (radioactive material may require State and Air Force licenses)
- other material descriptions such as density, specific volume, flash point, vapor pressure, toxicity, etc.
- special precautions and detection, collection, and disposal methods, if known.

#### **4.4 DATA PROCESSING**

Every effort is made to keep the productivity and quality of the test data high. This is accomplished by computing, tabulating, and displaying all the on-line data within the limits of the computer capacity. These data are processed and reduced to the desired form and format during the test run for use in the Wind Tunnel Control Rooms. If additional data reduction is required, it may be processed off-line after the test run. Consequently, the maximum benefit from the User or facility computer and other instrumentation can only be derived from careful planning by the User and the Calspan Project Engineer well in advance of the scheduled test period.

The information in Appendix C provides some important aspects of the data services available during and after completion of tests. Anticipated requirements should be discussed with the Calspan Project Engineer well in advance of the test.

#### **4.5 OPERATIONAL GUIDELINES**

Operational guidelines regarding lines of communication, work scheduling, safety procedures, etc., are listed in Appendix D for the purpose of emphasizing their importance to the User and Sponsor.

## **SECTION 5.0**

### **POST-TEST CONFERENCE**

On completion of the testing period, a Post-Test Conference is conducted to review and evaluate the test activities. If possible, representatives of the User, Sponsor, Air Force, and Calspan should participate. If schedules preclude a meeting at the completion of the test period, the meeting can be conducted just prior to completion of the test at the convenience of the User and Sponsor. The Project Engineer will provide the User and Sponsor with Post-Test Conference guidelines (AEDC Form 1) before or during the test.

The Project Engineer and the Air Force project manager serve as the leaders of the discussion which can include such topics as:

Adequacy of Data

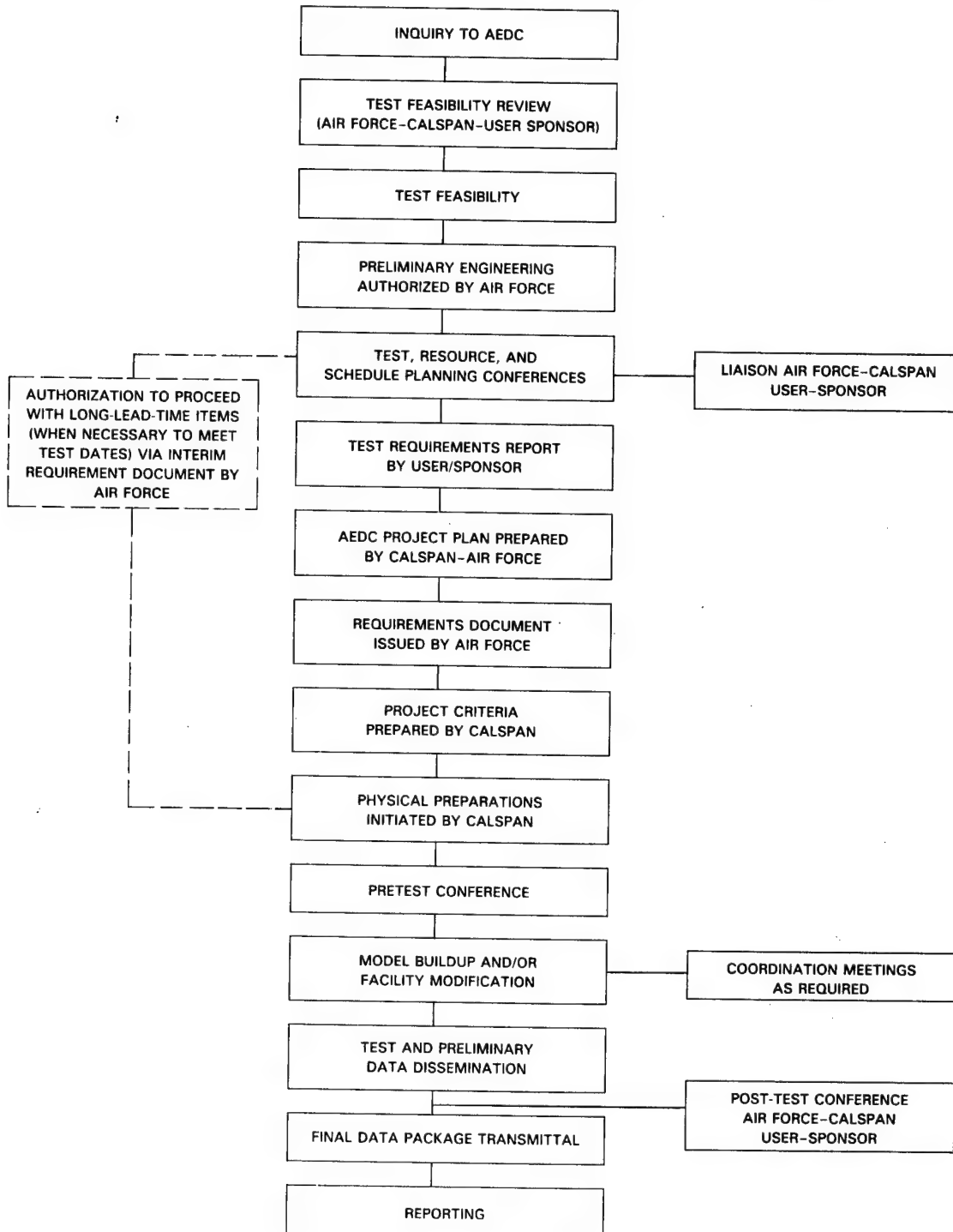
Quality of Data

Suggestions for Improvement in Testing Procedures

Communication and Exchange of Instructions between User and Calspan Personnel

The User and Sponsor should complete the AEDC Form 1 Test Critique prior to the post-test conference and discuss the critique at the conference. The results of the conference are summarized by the Project Engineer and given the prescribed distribution.

# **APPENDIX A** **TEST PROGRAM CYCLE - INQUIRY THROUGH REPORTING**



## **APPENDIX B**

### **GUIDELINES FOR USER PRETEST REPORTS**

#### **1.0 INTRODUCTION**

General purpose of the test, the sponsoring agency, very general description of test article and test conditions should be included.

#### **2.0 TEST OBJECTIVES**

Detailed description of all the test objectives with primary and secondary test objectives clearly identified.

#### **3.0 MODEL DESCRIPTIONS**

The model geometry of each phase of the test program clearly identified.

1. General (Design and Construction)
2. Drawings
3. Stress Analysis (May Be a Separate Document)
4. Reference Dimensions Used in Data Reduction
5. Inspection and Checkout Requirements
6. Specification of Personnel and Equipment Hazards Associated with the Test Article.

#### **4.0 INSTRUMENTATION REQUIREMENTS (Number, Type, and Location of Measurements)**

1. Force, Pressure, and Type of Heat-Transfer Measurements
2. Flow-Field Survey Measurements
3. Flow-Field Visualization Requirements
4. Other (Control System, Engine Parameters, etc.)

#### **5.0 INSTALLATION/OPERATION REQUIREMENTS**

1. General
2. Calibrations and Expected Uncertainties (Balance, Model Drive Systems, Internal Mass Flow, etc.)
3. Special Operating Procedures
4. Range of Expected Aerodynamic Model Loads and Model Weight
5. Special Handling Requirements (Model, Instrumentation, etc.)

## **6.0 TEST PROGRAM**

- 1. Primary Test Parameters (Scaling and Simulation Requirements)**
- 2. Secondary Test Parameters**
- 3. Tunnel Conditions**
- 4. Run Schedule**
- 5. Test Grid or Detailed Test Matrix**

## **7.0 DATA REDUCTION**

- 1. Nomenclature**
- 2. Model Axes System**
- 3. Special Data Analysis Requirements**
- 4. Tabulated Data Format**
- 5. Data Transmittal Requirements (Transit Tape, etc.)**
- 6. Plot Requirements**

## **8.0 SECURITY INFORMATION**

## **9.0 REFERENCES**



## **APPENDIX C**

### **AEDC TEST SUPPORT AND DATA PROCESSING CAPABILITIES**

#### **C.1 ON-LINE MACHINE TABULATED AND PLOTTED DATA**

All on-line tabulated and plotted data are available to the User and Sponsor in the Wind Tunnel Control Room during the test operation. These data are retained by the facility. One copy of these data is transmitted to the User and Sponsor Representatives at the facility during the work day following the test run.

#### **C.2 OFF-LINE MACHINE TABULATED DATA**

The off-line test data are processed generally during the day following the test run if these data are required for any decision affecting the next test run. One copy of these data is transmitted by the Air Force to the User and Sponsor Representatives generally within 30 days, depending on the computer work load and the nature of the data reduction requirements.

#### **C.3 MAGNETIC-TAPE DATA**

Users requiring copies of analog tape are required to furnish sufficient quantities of tape to record the data. Type and quantity of tape should be established during the Test Planning Conference. One copy of the reduced data on digital magnetic tape is supplied to the User.

#### **C.4 PHOTOGRAPHIC DATA**

One copy of photographic data (movie or still) is made available for the User within two weeks. If these data must be viewed before the next test run, a limited amount of film can be processed for immediate viewing. Only restricted use of the original films is permitted. A duplicate negative copy of the film will be transmitted to the User.

#### **C.5 OTHER PHOTOGRAPHIC COVERAGE**

One positive copy of documentary film (movie or still) covering test model configurations, details, etc., will be transmitted to the User as agreed during the planning conference.

## **C.6 FINAL DATA PACKAGE**

After completion of the test and certification of the test data by Calspan, the User and Sponsor will each receive one copy of the Final Data Package (FDP). The FDP will include: 1) one copy of the certified tabulated test data, 2) one copy of the certified test data on digital magnetic tape, 3) one copy of the Test Operation Data Log, 4) one print of each model test installation photograph, and 5) one copy of the Test Summary Report (TSR) (Section C.9). Other test items may be included in the Final Data Package as agreed upon during the Test Planning Conference (Section 3.1). Any distribution of the Final Data Package to other organizations should be discussed at the Test Planning Conference (Section 3.1) as a special requirement of the test program.

## **C.7 UNUSUAL DATA REQUIREMENTS**

Unusual requirements involving data reduction, printing format, number of printouts, reproducible copies of data, number of copies of data, special analyses, data transmittal, loan of original data, etc., should be discussed well in advance of the proposed tests, generally at the Pretest Conference between User and Calspan personnel.

## **C.8 ANALYSIS AND EVALUATION SUPPORT**

Analysis and evaluation support is available to the test sponsor for analysis and documentation of the results of the test program, for system performance prediction, and for correlation of the ground test data with flight test data. Analysis support activities should be discussed and the scope of the effort defined during the Test Planning Conference (Section 3.1).

## **C.9 REPORT REQUIREMENTS**

The reporting requirements for the test program are discussed and agreed upon during the Test Planning Conference (Section 3.1). Reports issued by the AEDC for dissemination of test data and test data analysis include: 1) Test Summary Report (TSR), 2) Technical Memorandum Report (TMR), and 3) Technical Report (TR).

1. *Test Summary Report.* A documentary to provide a permanent record of each test project or test phase with a description of the testing accomplished, description of the data obtained, disposition of the data package, and procedures for obtaining access to the data.
2. *Technical Memorandum Report.* A report that conveys the results of an analysis-type project and specific highlights or parts of a test. It is used to transmit information and

to provide a permanent record for Air Force use. It will be published in conjunction with a TSR and, since prompt reporting is a primary goal for a TMR, it will be produced in such a manner to minimize report preparation time.

3. *Technical Report.* A formal report published to document technical information generated at AEDC that is judged to be of residual value to the technical community. Technical Reports will be prepared when, in the judgment of the AEDC and Calspan, there is sufficient information from which to establish trends, explain phenomena, or in other ways enhance the scientific knowledge and facility disciplines supported at AEDC.

## **APPENDIX D**

### **OPERATIONAL GUIDELINES**

#### **D.1 LINES OF COMMUNICATION**

Lines of communication between Calspan and the User during the life of a test project are direct. The Calspan Project Engineer (PE) and the User Representative (UR), as designated in the Requirements Document, are the primary contacts in all technical matters for the test. Alternate PE's are permitted only when specifically designated by the PE or UR. During testing, it has been the practice of Calspan to have the PE or an alternate PE available at all hours of the day and to recommend that the User likewise have an alternate UR available. Such contacts are necessary because of scheduling requirements of model configuration changes and possible repairs, instrumentation changes, etc. If the UR is not available, model preparation and testing for that period may be delayed. It is recognized that subsidiary contacts are necessary in specific categories. The PE and UR will normally encourage direct communication between their respective specialized agents in the fields of design, fabrication, and instrumentation. It is the responsibility of such authorized agents to report their activities to the PE and UR. If there are any disagreements between the User and the Calspan Project Engineer concerning testing, scheduling, operating procedures, etc., it is expected the PE will contact the various levels of Calspan supervision to resolve the problem. Any changes in the test program which affect the schedule, scope, or objectives of the test must be coordinated with the Air Force Project Manager and the Sponsor for approval. If the Sponsor is not available for the test it is his responsibility to delegate the authority for decision-making purposes during testing.

#### **D.2 WORK SCHEDULING**

Implementation of work to be performed by Calspan personnel on test projects is always initiated by the PE. It is required that User personnel intending to work on the test model coordinate their activities with the Installation Supervisor on duty through the PE. This is necessary not only from a work scheduling standpoint, but because of the hazards which exist in the work areas with which the User personnel may not be acquainted.

#### **D.3 SAFETY PROCEDURES**

Safe operation of the Aerospace Flight Dynamics wind tunnels is the responsibility of Calspan. The safety procedures in effect in the AEDC facilities are designed for the protection of all personnel and to prevent equipment damage. User personnel will be informed of the specific procedures in force for their test by the PE or the Installation Supervisor. Any willful

violation or gross negligence concerning such procedures will be reported by Calspan management to User supervision and the Air Force.

#### **D.4 USE OF TOOLS**

Certain AEDC tools as designated by the Installation Supervisor are available in the model buildup areas for use by User personnel. User personnel may provide and operate any of their own special tooling or equipment that is necessary to support their test. Only AEDC contractor craft and technical personnel will operate the equipment available in the facility machine shops and instrument laboratories. Hand tools and portable power tools may be employed by User personnel for work on the model apparatus. Acquisition of these tools will be coordinated with the Installation Supervisor. Stock material can be ordered only by Calspan personnel.

#### **D.5 TEST ARTICLE AND INSTRUMENTATION CALIBRATIONS**

The calibration of instrumentation and control devices is directed by the PE and the UR. Only the PE has the authority to implement calibrations by Calspan personnel. If the UR has a requirement for calibrations to be made by User personnel, he will coordinate it with the PE to eliminate conflicts with other work schedules. All data taken during User calibrations must be made available to the PE. All reasonable User requests for calibrations will be satisfied. AEDC reserves the right, in the event of a disagreement with the User's calibration procedures, to either supplement them or to perform independent calibration.

If during wind tunnel testing the UR feels that the test data indicate significant instrument or model malfunctioning, he should immediately notify the PE to coordinate possible remedial actions.

#### **D.6 MODEL REPAIRS**

It is the policy of AEDC to provide top priority on resources to support programs during the testing period. A model is removed from the wind tunnel and testing terminated only in the event that the full use of available resources will not allow resumption of testing in a reasonable time. The reasonableness of repair time is a function of the total time scheduled for the test, the priority of the test results, and the turnaround time required (i.e., the time required to remove, repair, and reinstall the test model). Normally, a repair requirement infers a model deficiency which should be corrected by joint effort on the part of the User and Calspan.

## **D.7 MODEL MODIFICATIONS**

Occasionally, testing will disclose additional configurations or desirable changes in the model functional design. AEDC will cooperate with the User and attempt to meet any reasonable requirements regarding such model modifications. AEDC may recommend modifications to the model in order to expedite testing or to ensure adequate quality of test data.

## **D.8 INSPECTION OF WORK PERFORMED BY THE USER**

AEDC reserves the right to inspect any model work performed by the User. If the work is not considered satisfactory from the standpoint of structural integrity in critical areas, it may be necessary to have it reworked before testing is permitted. If rework is not feasible, the test conditions will be adjusted to minimize the likelihood of test unit damage.